

Marine Fisheries Research and Management

Editors

V.N. Pillai and N.G. Menon



Central Marine Fisheries Research Institute

(Indian Council of Agricultural Research)

Tatapuram P.O., Cochin-682 014

Kerala, India

2000

Marine Fisheries Research and Management

Marine Fisheries Research and Management

Central Marine Fisheries Research Institute
Tatapuram P.O., Cochin-682 014

© **CMFRI 2000** Copyright reserved

Published by

Dr. V.N. Pillai

Director,
Central Marine Fisheries Research Institute,
Tatapuram P.O., Cochin-14

ISBN : 81-9012 19 - 0 - 1

Citation styles

For entire volume

V.N. Pillai and N.G. Menon (Eds) 2000.
Marine Fisheries Research and Management,
Central Marine Fisheries Research Institute, Cochin,
pp. 914

For individual article

Devaraj M. and K.K. Appukuttan, 2000.
Perspective of coastal aquaculture in India.
In: *Marine Fisheries Research and Management*,
V.N. Pillai and N.G. Menon (*Editors*),
Central Marine Fisheries Research Institute, Cochin: 676-687

Price : **Rs. 500/-**

Printed at :

Cherrys Printers, Kaloor, Kochi-17.
Phone : 345681

PREFACE

After completing five decades of dedicated research in marine fisheries and allied subjects, the Central Marine Fisheries Research Institute, under the umbrella of ICAR, has gained considerable strength and confidence to manage Indian marine fisheries, which face challenging problems in respect of sustainability of coastal production, mariculture implications, exploration and exploitation of potential deep sea / oceanic pelagic, mesopelagic resources. The Institute has the responsibility to address all fishery research needs in the 8129-km long coast and 2.02 million km² EEZ waters. Accordingly, all our endeavors are directed towards solving the fishery dependent problems like ever increasing fishing pressure, demand for target resources, technology creep through mechanization / motorization and the resultant high fishing mortality, poor recruitment, overfishing etc. and related issues which might crop up from time to time consequent on irrational human pressure and interaction in a climatically limited fishable habitat and the conflicting interest groups that play in this sector. The excessive interference of man in the easily accessible shallow coast, the most vulnerable species, sensitive and fragile ecosystem in the wake of living resources exploitation, with the support of a strong technology, has not only depleted many resources, but also degraded or even denuded several inshore habitats and thereby even spoiled or disfigured the aesthetic beauty of the coasts, the coral reefs, the sea grass meadows, the mangroves, the estuaries etc. In order to solve the often-reported conflict between conservation and development in

marine fisheries sector, a strong and convincing database on fish biology, resource status, marine environment, socio economics of capture and culture fisheries are essential to evolve suitable management measures and to assess the adequacy of any crises / impact / stress management plan in this multiple resource user sector and to list out various mitigative measures for each impact. A regular monitoring of all these factors together with clear knowledge on the biology and behaviour of species in question are the minimum necessity to sustainably manage the exploited species / resources. Regular collection of all those parameters from a highly dynamic and climatically controlled habitat / ecosystem of Indian region is often beset with operational / infrastructure / human endurance limitations. In spite of the above constraints the Institute could generate volumes of data in space and time on all aspects in line with international standards and often this data base has been acclaimed world over and utilized for stock assessments / developing prediction models. The Institute is also looking forward to make the mariculture research and its outputs not only viable nationally but also competitive globally in an era when wild hunting slowly gives way to farming and domestication of coastal species. The voluminous database, infrastructure facilities coupled with the qualified scientific / technical manpower have empowered the Institute to take up consultancy services in diverse topics at globally competitive rates to serve all type of clients.

In connection with the Golden Jubilee of CMFR Institute, we have immense pleasure to bring out a publication entitled **"Marine Fisheries Research and Management"**. The review articles included in this book are written exclusively by the scientists / technicians of the Institute. The subject matters broadly focus on pelagic, demersal, crustacean and molluscan capture fisheries, national marine fish wealth, the environments, sensitive coastal ecosystems, pollution, gear impacts, potentials from the deep and hitherto little exploited resource realms, mariculture of

crustacean, molluscan, finfishes and other ancillary marine organisms, seaweed and fishery economics and extension. A wide spectrum of problems, prospects and management practices in line with the broad global outlook for 'responsible fishing', relevant to each resource and each situation are thoughtfully dealt with in the articles along with an exhaustive list of references in the subjects concerned. The authors have taken sincere efforts to synthesize and interpret the data gathered over the years, into knowledge for the direct use to fishermen, entrepreneurs, scientists, students, managers and policy makers.

I am glad to express my gratitude to Dr. M. Devaraj, former Director of CMFRI, for initiating this task to publish a compendium on the major research results of the Institute during the last five decades (1947 - 1997). I take this opportunity to thank all contributors of this Institute, external referees like Shri. C. Mukundan, Dr. M.M. Thomas, Shri. K.H. Mohammed, Dr. A. Noble and Shri. K. Raman, Retired Scientists, and other senior colleagues of the Institute for the critical evaluation of the papers and Drs. K. Rengarajan, V.S.R. Murthy, K.J. Mathew and N.G. Menon, members of Golden Jubilee publication committee, CMFRI, for the help rendered at one time or other during the preparation of this book. I hope that this book would serve as an excellent guide to students of fishery science, researchers, managers, entrepreneurs and policy makers.

Cochin
June 2000

Dr. V.N. Pillai
Director

Contents

Preface	v
MARINE BIOLOGY	
1. Phytoplankton	1
C.P. Gopinathan and V.K. Balachandran	
2. Primary production	9
C.P. Gopinathan and V.K. Balachandran	
3. Seaweeds	21
V.S.K. Chennubhotla, N. Kaliaperumal, Reta Jayasankar, S. Kalimuthu . J. R. Ramalingam, K. Muniyandi and M. Selvaraj.	
4. Studies on Chaetognatha of the Indian EEZ	38
K.J. Mathew	
5. Studies on Euphausiacea (Crustacea) of the Indian Ocean with special reference to the EEZ of India.	48
K.J. Mathew	
6. Studies on ostracods of the Indian seas	68
Molly Varghese	
7. Studies on planktonic amphipods of the Indian seas	80
Molly Varghese	
8. Studies on the Mysidacea of the Indian coasts	98
T.S. Naomi	
9. Sponges – systematics, as pests of molluscs, agents of bioerosion and a source of bioactive compounds	108
P.A. Thomas	
10. Sea cucumbers	124
D.B. James	
11. Sea turtles	152
M. Rajagopalan	
12. Studies on the mangrove ecosystem	162
G.S. D. Selvaraj	

13 **The study of mudbanks of the Kerala coast – a retrospect** 177
K.J. Mathew and C.P. Gopinathan

MARINE FISHERIES

14	An appraisal on the marine fishing craft and gear of the Indian coast P.K.Mahadevan Pillai , G. Balakrishnan, Varughese Philipose and V. Rajendran	191
15	Marine fisheries of Orissa K.S. Scariah, C.J. Prasad, V.P. Annam and Lata L. Khambadkar	223
16	Marine fisheries in Gujarat K.S. Scariah, V.P. Annam ,C.J. Prasad and P.T. Mani	237

PELAGIC RESOURCES

17	Pelagic fisheries resources of India – an overview N.G.K. Pillai and P.P. Pillai	249
18	The Indian oil sardine A.A. Jayaprakash and N.G.K. Pillai	259
19	Lesser sardines resources of India Prathibha Rohit and P. Sam Bennet	282
20	Whitebaits G.Gopakumar and N.G. K. Pillai	296
21	Fishery, biology and resource characteristics of golden anchovy, <i>Coilia dussumieri</i> (Cuv. & Val.) Mohammad Zafar Khan	310
22	Carangid resources of India P.N. Radhakrishnan Nair	317
23	The Bombay duck : stock status and response to exploitation Alexander Kurian	349
24	The fishery and resource characteristics of pomfrets Mohammad Zafar Khan	364
25	Fishery, stock assessment and management of the barracuda resource in India H. Mohamad Kasim	374
26	The Indian mackerel T.M. Yohannan and K.P. Saidkoya	388
27	Tuna fisheries of India P.P.Pillai and N.G. K. Pillai	405

28	Exploited seerfish fishery resources of India – a review	426
	C. Muthiah, H.M. Kasim and Uma S. Bhat	
29	Tuna livebaits	468
	M. Sivadas and A.K. V. Nasser	
30	Application of remote sensing techniques for locating pelagic fish concentrations along the Kerala coast. (SW coast of India) – work done and future prospects	479
	V. Narayana Pillai, K. M. Santosh, K. M. Shivaraj and Saji K .David	
DEMERSAL RESOURCES		
31	An introduction to demersal fin fish resources	495
	P. Bensam	
32	Prawn fisheries of important brackishwater and estuarine systems in India	499
	Mary K Manisseri and G. Sudhakara Rao	
33	The Indian tiger prawn <i>Penaeus monodon</i> Fabricius	511
	G. Sudhakara Rao	
34	Edible and ornamental gastropod resources	525
	K.K. Appukuttan and K. Ramadoss	
35	The pearl oysters	536
	A.Chellam, A.C.C. Victor, S. Dharmaraj and T.S. Velayudhan	
36	A review on cephalopod resources, biology and stock assessment in Indian seas	546
	M.M. Meiyappan, K.S. Mohamed, K.Vidyasagar, K.P. Nair, N. Ramachandran, A.P. Lipton, G.S. Rao, V.Kripa, K.K.Joshi, E.M. Abdussamad, R. Sarvesan and G.P.K.Achary	
37	Elasmobranch resources of India	563
	P. Devadoss, E. Vivekanandan, S.G. Raje, Grace Mathew and S. Chandrasekar	
38	Marine catfish resources of India	579
	N.Gopinatha Menon, K. Balachandran, P.U. Zacharia, S.G. Raje and M. Feroz Khan	
39	The fishery biology and stock assessment of jew fish resources of India	604
	S.K. Chakraborty, P. Devadoss, P.P. Manojkumar, M. Feroz Khan, P.Jayasankar, S.Sivakami, V. Gandhi, Y. Appanna Sastry, A. Raju, P. Livingston, K.M.S. Ameer Hamsa, M. Badruddin, P. Ramalingam,	

	V.M. Dharieswar, C.V. Seshagiri Rao., K. Nandakumaran, B.B. Chavan and P.K. Seetha.	
40	Flatfishes, goatfishes and whitefishes	617
	P.Bensam, P. Devadoss, Grace Mathew, K.M.S. A. Hamsa, V. Gandhi. S. Lazarus, P.U. Zacharia, M. Feroz Khan and P.Jayasankar	
41	Exploited resources of major perches in India	636
	Grace Mathew, P. Nammalwar, S.K. Chakraborty, P. Livingston, K.K. Philippose and K.M.S. Ameer Hamsa	
42	The deep scattering layer (DSL) of Indian EEZ	656
	N.G. Menon	
43	Artificial reefs	669
	M. Rajamani S. Lazarus, P.P. Pillai and T.M. Yohannan	

MARICULTURE

44	Perspective on coastal aquaculture in India	677
	M. Devaraj and K.K. Appukuttan	
45	Culture of live feed organisms	688
	K.G. Girijavallabhan, C.P. Gopinathan, Molly varghese and D .Prema	
46	Seed production and hatchery management of <i>Penaeus indicus</i>	704
	N.Neelakanta Pillai, G. Maheswarudu and K. R. Manmadhan Nair	
47	Broodstock development and spawning in <i>Penaeus indicus</i>	714
	G. Maheswarudu, N.Neelakanta Pillai, and K. R. Manmadhan Nair	
48	Shrimp farming – a status review	727
	K. Asokakumaran Unnithan	
49	Mud crab hatchery technology	747
	R. Marichamy and S. Rajapackiam	
50	Problems and prospectus for lobster farming in India	753
	E.V. Radhakrishnan and M. Vijayakumaran	
51	Breeding, rearing and sea-ranching of chanks	765
	A.P. Lipton and M. Selvakku	
52	Pearl culture	775
	A.C.C. Victor, A. Chellam and S. Dharmaraj	
53	The edible oyster culture	786
	P.Muthiah, M.E.Rajapandian, K. Ramadoss, K.K. Appukuttan and T.S.Velayudhan	

	Contents
54 A review of marine finfish culture experiments in India	802
P. Bensam	
55 Culture of the sea bass <i>Lates calcarifer</i>	818
R. Marichamy, H. Mahamed Kasim, V.S. Rengaswamy , K.M..S. Ameer	
Hamsa and S. Rajapackiam	

SOCIO-ECONOMICS AND EXTENSION

56 Economics of different production technologies in culture fisheries	826
R. Sathiadhas, D.B.S. Sehara, K.K.P.Panikkar and R. Narayana Kumar	
57 Economic evaluation of different types of fishing methods along Indian coast	846
D.B.S. Sehara, R. Sathiadhas, K.K.P.Panikkar and R. Narayana Kumar	
58 Distribution problems and marketing management of marine fisheries in India	858
R. Sathiadhas and A. Kanagam	
59 Marine fish production and export marketing trend in Kerala – an economic analysis	876
R. Sathiadhas , R. Reghu, A. Kanakkan and N.K. Harsha	
60 Socio-economic analysis of marine fishermen in India	895
R. Narayana Kumar, K.K.P.Panikkar, D.B.S. Sehara and R. Sathiadhas	
61 Potential techno-economic role of women in fisheries	907
Sheela Immanuel and Krishna Srinath.	